

What is claimed is:

1. Apparatus for non-invasively treating patent foramen ovale comprising:

a housing;

an ultrasound imaging system disposed within the housing;

a high intensity focused ultrasound system disposed within the housing in alignment with the ultrasound imaging system; and

a controller operably connected to the ultrasound imaging system and high intensity focused ultrasound system to selectively target high intensity ultrasound energy on either or both of a patient's septum primum or septum secundum.

2. The apparatus of claim 1 wherein the controller ultrasound imaging system and the high intensity focused ultrasound system comprise common transducers.

3. The apparatus of claim 1 wherein the controller is programmed to display a marker corresponding to a focal point of the high intensity focused ultrasound system.

4. The apparatus of claim 3 wherein the controller is programmed to adjust a location of the focal point of the high intensity focused ultrasound system within a two-dimensional plane orthogonal to an axis of the high intensity focused ultrasound system.

5. The apparatus of claim 3 wherein the controller is programmed to adjust a location of a depth

of the focal point of the high intensity focused ultrasound system.

6. The apparatus of claim 1 further comprising a fluid-filled balloon coupled to the housing to adjust a location of the focal point of the high intensity focused ultrasound system.

7. The apparatus of claim 1 wherein the patient's septum primum and septum secundum are apposed during treatment.

8. The apparatus of claim 7, wherein apposition of the patient's septum primum and septum secundum is achieved noninvasively using drugs, noninvasive procedures, or a combination thereof.

9. The apparatus of claim 7, wherein increased contact pressure between the patient's septum primum and septum secundum is achieved noninvasively using drugs, noninvasive procedures, or a combination thereof.

10. A method of non-invasively treating patent foramen ovale comprising:

providing a housing having an ultrasound imaging system and a high intensity focused ultrasound system disposed in alignment with the ultrasound imaging system;

contacting the housing against a patient's body;

operating the ultrasound imaging system to generate an image of a portion of cardiac tissue; and

operating the high intensity focused ultrasound

system, guided by the image, to heat or ablate either or both of a patient's septum primum or septum secundum.

11. The method of claim 10 further comprising generating and displaying a marker corresponding to a focal point of the high intensity focused ultrasound system on the image.

12. The method of claim 10 further comprising modifying a location of the target site by adjusting a location of the focal point of the high intensity focused ultrasound system.

13. The method of claim 10 further comprising disposing a fluid-filled balloon between the patient's body and the housing to adjust a location of the focal point of the high intensity focused ultrasound system.

14. The method of claim 10 further comprising apposing the patient's septum primum and septum secundum noninvasively using drugs, noninvasive procedures, or a combination thereof.

15. The method of claim 10 further comprising increasing contact pressure between the patient's septum primum and septum secundum is noninvasively using drugs, noninvasive procedures, or a combination thereof.

16. Apparatus for intraluminally treating patent foramen ovale comprising:

a catheter;

an ultrasound imaging system disposed within the catheter;

a high intensity focused ultrasound system disposed within the catheter in alignment with the ultrasound imaging system; and

a controller operably connected to the ultrasound imaging system and high intensity focused ultrasound system to selectively target high frequency ultrasound energy on either or both of a patient's septum primum or septum secundum.

17. The apparatus of claim 16 wherein the controller ultrasound imaging system and the high intensity focused ultrasound system comprise common components.

18. The apparatus of claim 16 wherein the controller is programmed to display a marker corresponding to a focal point of the high intensity focused ultrasound system.

19. The apparatus of claim 18 wherein the controller is programmed to adjust a location of the focal point of the high intensity focused ultrasound system within a two-dimensional plane orthogonal to an axis of the high intensity focused ultrasound system.

20. The apparatus of claim 18 wherein the controller is programmed to adjust a location of a depth of the focal point of the high intensity focused ultrasound system.

21. The apparatus of claim 16 wherein the high intensity focused ultrasound system is configured to focus along a linear ablation target.

22. The apparatus of claim 16 wherein the patient's septum primum and septum secundum are apposed during treatment.

23. The apparatus of claim 22, wherein apposition of the patient's septum primum and septum secundum is achieved noninvasively using drugs, noninvasive procedures, or a combination thereof.

24. The apparatus of claim 22, wherein increased contact pressure between the patient's septum primum and septum secundum is achieved noninvasively using drugs, noninvasive procedures, or a combination thereof.

25. A method of treating patent foramen ovale comprising:

providing a catheter having a distal portion housing an ultrasound imaging system and a high intensity focused ultrasound system disposed in alignment with the ultrasound imaging system;

disposing the distal portion of the catheter within a patient's body lumen;

operating the ultrasound imaging system to generate an image of a portion of cardiac tissue; and

operating the high intensity focused ultrasound system, guided by the image, to heat or ablate either or both of the patient's septum primum or septum secundum.

26. The method of claim 25, wherein the body lumen is the esophagus.

27. The method of claim 25, wherein the body

lumen is the aorta.

28. The method of claim 25, wherein the body lumen is the right atrium.

29. The method of claim 25, wherein the body lumen is the inferior vena cava.

30. The method of claim 25, wherein the body lumen is the superior vena cava.

31. The method of claim 25 further comprising generating and displaying a marker corresponding to a focal point of the high intensity focused ultrasound system on the image.

32. The method of claim 25 further comprising modifying a location of the target site by adjusting a location of the focal point of the high intensity focused ultrasound system.

33. The method of claim 25 further comprising apposing the patient's septum primum and septum secundum noninvasively using drugs, noninvasive procedures, or a combination thereof.

34. The method of claim 25 further comprising increasing contact pressure between the patient's septum primum and septum secundum is noninvasively using drugs, noninvasive procedures, or a combination thereof.